Figure 2 illustrates a distal portion of an inner cannula 116 which forms a part of cannula 102. Inner cannula 116 is generally tubular, and has a longitudinal axis 118 which extends between a distal end 120 and a proximal end (not illustrated). Inner cannula 116 includes a main tissue lumen 122 which extends longitudinally from the proximal end to the distal end 120. Inner cannula 116 is preferably formed of a relatively rigid, electrically non-conductive, and biocompatible material. The proximal portions of inner cannula 116, not illustrated in Figure 2, are generally tubular like the distal portions thereof illustrated in Figure 2.

Inner cannula 116 further includes a cutout, slot, window, or fenestration 124 through the sidewall 126 of inner cannula 116, which exposes main lumen 122 to the exterior of the inner cannula. Cutout 124 is preferably formed by two sidewalls 128, 130, a distal endwall 132, and a proximal endwall 134. More preferably, sidewalls 128, 130 are longitudinally extending, i.e., extend parallel to axis 118, and endwalls 132, 134 extend perpendicular to sidewalls 128, 132. The angular separation of sidewalls 128, 130, that is, the angle α which is defined between sidewalls 128, 130, is selected so that the cutout 124 is large enough to allow a cutting loop 138 of a cutting wire 136 to be rotated in and out of main lumen 122, as described in greater detail below. Angle α is typically about 180°, although other values for angle α are within the spirit and scope of the invention as will be readily apparent to one of ordinary skill in the art.

Inner cannula 116 is optionally provided with a lubricious coating 142 on the inner side of sidewall 126, which allows a tissue sample to be more easily drawn along main lumen 122. Inner cannula 116 is also optionally provided with a lubricious coating 144 on the outer side of sidewall 126, which allows the inner cannula to be more easily rotated within an outer cannula (see Figure 4) of cannula 102.

A cutting wire 136 is provided in inner cannula 116. Cutting wire 136 includes a cutting loop 138 and a longitudinally extending actuating portion 140. Actuating portion 140 is slidably received in a passageway which extends from the proximal end of cannula 102 to the region of cutout 124. In the embodiment illustrated in Figure 2, the passageway which receives actuating portion 140 is a small, second lumen 146 formed in sidewall 126 of inner cannula 116. Alternatively, as illustrated in Figure 3c, the passageway can take the form of a channel 146′ formed in the external surface of inner cannula 116, in which actuating portion 140 is slidably and rotatably received. Channel 146′ cooperates with the internal surface of an outer cannula 152 (see Figure 4a) to retain actuating portion 140 in channel 146′. According to yet another embodiment, the passageway can be formed as a channel 146′′ in the inner surface of outer cannula 152, as illustrated in Figure 3d (see also Figure 4a). According to yet another embodiment, illustrated in Figure 3e, the passageway is formed as two shallower channels 149, 151, one formed in each of the external surface of inner cannula 116 and the internal surface of outer cannula 152. In the embodiment illustrated in Figure 3e, one of shallow channels 149, 151 (channel 151 in Figure 3e) has a much larger circumferential length which describes an angle ϵ, than the other shallow channel, to allow inner cannula 116 and outer cannula 152 to rotate relative to each other without being locked by actuating portion 140, for reasons described in greater detail below. Preferably, angle ϵ is greater than or equal to angles α and β, described below with reference to Figure 4a and 4b. Lumen 146 or channels 146′, 146′′, or 149 and 151 are optionally also coated with a lubricious material to facilitate sliding cutting wire 136 therethrough.

In the embodiment illustrated in Figure 2, cutting loop 138 is a generally circular and closed loop, and preferably lies in a plane perpendicular to a longitudinal axis 148 of actuating portion 140 and lumen 146. Cutting loop 138 can take forms other than a generally circular closed loop, as described in greater detail below.

Figure 2 illustrates lumen 146 continuing on the distal side of cutout 124; optionally, lumen 146 terminates at proximal endwall 134 and opens into cutout 124.

Cutting loop 138 is both longitudinally extendable in cutout 124, and rotatable into and out of lumen 122, because actuating portion 140 is slidably and rotatably received in the passageway. As discussed above with reference to angle α, the size of cutout 124 is selected so that cutting loop 138 is rotatable from a first position (illustrated in Figure 2) in which the cutting loop is entirely contained within inner cannula 116, and a second position in which the cutting loop has been rotated around axis 148 so that almost all of the cutting loop has passed through the cutout and is outside of the inner cannula. Because actuating portion 140 of cutting wire 136 remains in the passageway, e.g., lumen 146, in both the first and second positions, those portions of cutting loop 138 immediately adjacent the actuating portion 140 will not extend beyond the outer wall of sidewall 126 in the second position.

Lumen 146 is preferably located in sidewall 126 so that it intersects proximal endwall 134 at a location significantly closer to one of sidewalls 128, 130, than the other of the sidewalls of cutout 124. While lumen 146 can, in a less preferred embodiment, be centered between sidewalls 128, 130, locating lumen 146 so that actuating portion 140 of cutting wire 136 is immediately adjacent one of sidewalls 128, 130 allows cutting loop 138 to be made much larger than if lumen 146 were closer to being centered. Thus, locating lumen 146 in sidewall 126 immediately adjacent sidewall 128, as illustrated in Figure 2, allows for a larger cutting loop 138, because the distance between axis 148 and the opposite sidewall (130, as illustrated in Figure 2) is larger, thus providing more space for the cutting loop to rotate out of lumen 122. This allows cutting loop 138 to be relatively large. Inner cannula 116 further includes an electrical conductor 150 in sidewall 126, which extends from the proximal end to the distal end 120 of the inner cannula. Electrical conductor 150 is provided to provide electrical communication between RF generator 106 and a cutting